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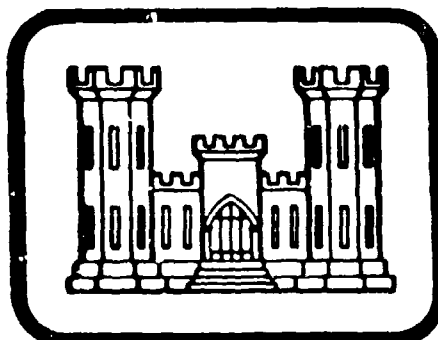
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SUSQUEHANNA RIVER BASIN
KEHM RUN DAM
DR. RAY W. KEHM

NDI NO. PA-01029
DER NO. 67-483

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YORK COUNTY, PENNSYLVANIA
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



PA CW 31-81-C-0013
PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

BY
Berger Associates
Harrisburg, Pennsylvania 17105

JULY 1981

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PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam: KEHM RUN DAM
State & State No.: PENNSYLVANIA, 67-483
County: YORK
Stream: KEHM RUN, TRIBUTARY TO MILL CREEK
Date of Inspection: APRIL 27, 1981

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in poor condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small, and the hazard classification is significant. These classifications indicate that the Spillway Design Flood (SDF) should be in the range of the 100 year flood to one-half the Probable Maximum Flood (PMF). The recommended SDF for this structure is the 100 year flood. The spillway capacity is sufficient for passing the SDF peak inflow without overtopping the dam. The spillway, therefore, is considered to be adequate.

The following recommendations are presented for immediate action by the owner:

1. That all brush and trees be removed from the embankment.
2. That a professional engineer, experienced in the design and construction of dams, evaluate the seepage condition and wet condition on the downstream slope and in the immediate downstream area. His report should indicate if corrective measures are required.
3. That a method be provided for upstream closure of the draw-down pipe.
4. That the crack in the spillway wall be monitored and corrective measures be taken if any movement occurs.

KEHM RUN DAM

NDI NO. PA-01029

DER NO. 67-483

DR. RAY W. KEHM

YORK COUNTY

5. That the embankment be reseeded to provide a protective cover.
6. That a maintenance program be established for regular maintenance of the embankment.
7. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.
8. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

SUBMITTED BY:

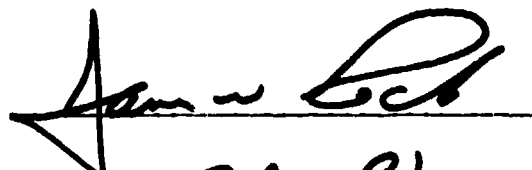
BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: July 31, 1981

APPROVED BY:

James W. Peck
Colonel, Corps of Engineers
Commander and District Engineer




DATE: 7 Aug 81

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OVERVIEW

KEHN RIN DAN

Photograph No. 1

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KEHM RUN DAM

NDI NO. PA-01029
DER NO. 67-483

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Note: A design drawing for this dam (Plate III, Appendix E) indicate a spillway elevation of 119.0 (normal pool). It was estimated from the U.S.G.S. Quadrangle sheet that normal pool elevation is 610.0. Elevation 610.0 was used as the elevation of the spillway crest for this report.

Kehm Run Dam consists of a 270 foot long zoned earthfill structure which has a maximum embankment height of 27 feet above the streambed at the downstream toe. The ogee type spillway has a width of 24 feet and is located in the left abutment. A 12-inch drawdown line is located near the center of the embankment. This pipe has a downstream control. A small dam was constructed at the upstream end of the reservoir. Normal flows pass directly through an open slide gate in this dam into the reservoir. When the inflow increases, the gate closes and the inflow enters an 18-inch by-pass pipe which passes under the reservoir and embankment and discharges downstream. This by-pass was installed to reduce sedimentation in the reservoir.

B. Location:

York Township, York County
U.S.G.S. Quadrangle - York, PA
Latitude 39°-55.4', Longitude 76°-40.1'
Appendix E, Plates I & II

- C. Size Classification: Small: Height - 27 feet
Storage - 59.5 acre-feet
- D. Hazard Classification: Significant (Refer to Section 3.1.E.)
- E. Ownership: Dr. Ray W. Kehm
R.D. #3
York, Pennsylvania 17402
- F. Purpose: Recreation and Irrigation
- G. Design and Construction History

The dam and its appurtenant structures were designed by R.W. Weidner and the drawings are dated January 1953. Final revisions are dated May 28, 1953. A permit for construction was issued by the Department of Environmental Resources (PennDER) on July 8, 1953. Stewart and March of York, Pennsylvania, the contractor, completed construction in January 1954. A final inspection by PennDER was made on February 16, 1954.

H. Normal Operating Procedures

The reservoir is used by the owner for irrigation of farm land and for recreation. All inflow above normal pool is discharged over the spillway. The owner stated that the drawdown valve is opened in the fall for flushing of the pipe. The slide gate on the upstream dam closes automatically when the level behind this dam reaches a level to activate a float device.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	0.9
Computed for this report:	0.88
Use:	0.88

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations.

Maximum known flood (estimated from U.S.G.S. gage records at nearby Winterstown, PA)	953
Outlet works at pool Elev. 610	15
Outlet works at low pool Elev. 598	8
By-pass at headwater Elev. 616	16

Spillway capacity at pool Elev. 614.0 (low point of dam)		752
C.	<u>Elevation</u> (feet above mean sea level)	
	Top of dam (low point)	614.0
	Top of dam (design crest)	614.5
	Spillway crest	610.0
	Upstream portal invert (design)	593.0
	Downstream portal invert (survey)	589.5
	Streambed at downstream toe of dam (estimate)	587
D.	<u>Reservoir</u> (miles)	
	Length of normal pool (Elev. 610.0)	0.1
	Length of maximum pool (Elev. 614.0)	0.2
E.	<u>Storage</u> (acre-feet)	
	Spillway crest (Elev. 610.0)	36.8
	Top of dam (Elev. 614.0)	59.5
F.	<u>Reservoir Surface</u> (acres)	
	Spillway crest (Elev. 610.0)	4.6
	Top of dam (Elev. 614.0)	6.8
G.	<u>Dam</u>	
Refer to Plates III and IV in Appendix E for plan and section.		
Type:	Zoned earthfill.	
Length:	270 feet.	
Height:	27 feet.	
Tod Width:	Design - 10 feet; Survey - 10 feet.	
Side Slopes:	<u>Design</u>	<u>Surveyed</u>
	Upstream 2.0H to 1V	1.9H to 1V
	Downstream 2.0H to 1V	2.0H to 1V

Zoning: A core of selected material with more pervious material placed in the outside shell.

Cutoff: None.

Grouting: None.

H. Outlet Facilities

Type: 12-inch R.C.P. encased in concrete with downstream valve. Downstream end extended with a steel pipe.

Inlet: Elevation 593.0 with headwall and trashrack.

Outlet: Invert elevation 589.5

Location: Center of dam.

I. Spillway

Type: Concrete ogee section.

Length
of Weir: 24 feet.

Crest
Elevation: 610

Location: Left abutment.

J. Regulating Outlets

See Section 1.3.H. above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The available engineering data for Kehm Run Dam are limited to two design drawings and a report filed by PennDER upon the application for a permit for construction. The drawings have been reproduced in Appendix E of this report. The PennDER report states that the capacity of the spillway was considered to be adequate at the calculated value of 870 cfs.

2.2 CONSTRUCTION

The available construction data are limited to a letter stating that the construction was completed in January 1954. A copy of the construction specification is available for review. A final inspection was made by PennDER on February 16, 1954. The inspection report indicates that the construction was completed in accordance with the plans. The 18-inch by-pass was placed below the drawdown pipe and was encased in concrete. At the time of inspection, the by-pass pipe had a considerable flow (equivalent to a 16-inch pipe) and apparently had a leak in the reservoir area.

2.3 OPERATION

Formal records of operation are not maintained by the owner. Maximum discharges over the spillway crest are unknown. An inspection report by PennDER dated June 1960 reports the dam in good condition and no indication of leakage.

2.4 EVALUATION

A. Availability

The available engineering data is contained in the files of PennDER, Harrisburg, Pennsylvania.

B. Adequacy

The available engineering and construction data, combined with the field inspection, are considered to be adequate for making a reasonable assessment of the dam.

C. Operating Records

Operating records, including maximum pool levels, have not been maintained.

D. Post Construction Changes

The visual inspection did not reveal that post construction changes were made at these facilities.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of Kehm Run Dam is poor. The embankment is covered with a dense growth of brush and some trees. Seepage was noticed in several areas, and several areas downstream of the toe are wet and soft. The dense growth on the slopes prevented close observation for detection of slides or sloughage.

The visual inspection check list and sketches of the general plan and profile of the dam, as surveyed during the inspection, are presented in Appendix A of this report. Photographs of the facilities taken during the inspection are reproduced in Appendix C. Dr. Ray Kehm, the owner, accompanied the inspectors.

B. Embankment

The horizontal alignment of the embankment is good. The vertical profile of the dam (Plate A-II, Appendix A), indicates that the crest of the dam is below the design crest elevation adjacent to the spillway walls.

The upstream slope is protected with dumped rock. Close observation of the condition of the dumped rock was not feasible due to the heavy growth of briars (Photograph No. 3). The surveyed profile of the crest indicates low areas adjacent to the spillway walls. The crest is covered with knee-high grass.

The downstream slope is covered with briars, brush, and small trees and could be inspected only at a few locations (Photographs No. 4 and No. 5). Seepage on the slope was detected at two locations (refer to Plate A-I). The area immediately downstream of the toe was wet, swampy and soft at several locations. There was only a slight flow of water noticed. Its volume could not be estimated.

C. Appurtenant Structures

The ogee spillway weir is located near the left abutment. The approach to the spillway from the reservoir is unobstructed. The concrete weir is in good condition with only slight deterioration of the surface. The spillway discharge channel curves to the right and narrows from 24 feet at the upstream end to 10 feet at the downstream end. The concrete slab and the vertical walls are in good condition. One crack was noticed at the ogee section in the left abutment wall (Photograph No. 9). Heavy brush and some trees are growing close to the walls. A small rock lined plunge pool is located immediately downstream of the concrete spillway chute.

The outlet facilities consist of a 12-inch pipe with a downstream valve control. The outlet for this drawdown pipe is a steel pipe located immediately above an 18-inch pipe. The 18-inch pipe is connected with an upstream intake structure and is activated during higher flows. Drawings indicate a 12-inch pipe for this by-pass.

D. Reservoir Area

The reservoir has moderate to flat slopes. The slopes appear to be stable. Sedimentation has been reported by the owner, although it was not indicated how extensive this siltation is. The drainage area is mostly farm land with several small residential developments.

E. Downstream Channel

The immediate downstream channel for the drawdown pipe and the spillway were excavated at the time of construction and join the natural stream about 100 feet downstream of the dam. Both discharge channels are overgrown with brush.

A farm with a barn, a house, and a commercial greenhouse are located about 3000 feet downstream of the embankment where the creek crosses under a township road. The barn and greenhouse are located in the floodplain. Based on the field observation, there is a potential for loss of a few lives downstream. The hazard category for Kehm Run Dam is therefore considered to be "Significant."

3.2 EVALUATION

The overall visual evaluation of Kehm Run Dam indicates that the facilities are in poor condition. The heavy growth of brush and trees on the embankment should be removed to allow a better inspection of the slopes. The seepage and soft condition of the toe is of concern and should be further investigated. The spillway appears to be in good condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The dam and reservoir were constructed to provide irrigation water and for recreational purposes. All inflow above the normal pool level is discharged over the spillway. Maintenance procedures for the embankment do not exist. The owner opens the downstream valve in the fall to flush the pipe.

4.2 MAINTENANCE OF THE EMBANKMENT

The embankment is overgrown with dense brush and small trees. There are apparently no maintenance procedures for the embankment.

4.3 MAINTENANCE OF OPERATING FACILITIES

The valve on the drawdown line is apparently opened on an annual basis.

4.4 WARNING SYSTEM

There is no formally organized surveillance and downstream warning system in existence at the present time.

4.5 EVALUATION

The operational procedures for Kehm Run Dam are inadequate. It is recommended that a program be developed for regular mowing of the embankment after all brush and trees are removed. A formal surveillance plan and downstream warning system should be developed for implementation during periods of heavy or prolonged rainfall.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from PennDER for Kehm Run Dam was not very extensive. No area-capacity curve, frequency curve, unit hydrograph, design storm, design flood hydrograph, or flood routings were available. A note in the PennDER file indicates that the spillway was designed for a flow of 870 cfs. It was reported that the spillway was designed for a 50 year storm.

B. Experience Data

There are no records of flood levels at Kehm Run Dam. Based on records of the U.S.G.S. stream gage on East Branch Codorus Creek at nearby Winterstown, Pennsylvania, the maximum inflow of Kehm Run Dam is estimated to be 953 cfs and occurred in 1975. There are no reports of this dam having been overtopped at that occasion.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event. Just upstream of the reservoir is a small diversion dam with a float activated closure. A concrete pipe extends from the diversion dam, beneath the reservoir, and through the embankment of Kehm Run Dam, and discharges at the downstream toe. During periods of high flow, this upstream dam and the by-pass pipe divert a small amount of water past Kehm Run Dam.

D. Overtopping Potential

Kehm Run Dam has a total storage capacity of 59.5 acre-feet and an overall height of 27 feet above streambed. These dimensions indicate a size classification of "Small." The hazard classification is "Significant" (see Section 3.1.E.).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is in the range of the 100 year flood to one-half the Probable Maximum Flood (PMF). Because of the small storage capacity for this dam, the recommended SDF is the 100 year flood. For this dam, the SDF peak inflow is 518 cfs. (See Appendix D for inflow computations.)

Comparison of the estimated SDF peak inflow of 518 cfs with the estimated spillway discharge capacity of 752 cfs indicates that a potential for overtopping of the Kehm Run Dam does not exist. The spillway can pass the SDF without overtopping the low point of the dam profile.

E. Spillway Adequacy

Since the spillway discharge capacity can pass the SDF without overtopping, the spillway is considered to be adequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

The visual inspection of Kehm Run Dam was limited due to the heavy and dense growth on the embankment. There were no signs of slides or sloughage. Seepage was detected on the downstream slope and the area downstream of the toe is wet, swampy and soft at several locations. The field survey indicates that the slopes of the embankment approximately match the design slopes.

B. Appurtenant Structures

Visual inspection of the spillway and spillway discharge channel did not detect any signs of instability. There were no signs of movement. One crack in the left spillway abutment wall has developed. It does not appear to be serious at the present time.

C. Design and Construction Data

1. Embankment

The typical embankment section (Plate III, Appendix F) indicates a zoned earthfill with selected material forming the central core. The drawings and specifications indicate that the topsoil was removed prior to placing of the fill material. A cutoff trench was not excavated. The test borings on Plate IV indicate that the underlying soil consists of hard clay and clayey shale. A toe drain or foundation drain was not installed. Stone riprap was placed on the upstream slope from an elevation three feet below normal pool to the crest of the dam.

2. Appurtenant Structures

The ogee spillway section is a solid concrete block founded on clay and stone. The base width is 13.5 feet and the height is six feet. The spillway walls are of varying height. The gravity type sections have a bottom width of one quarter of the height plus one foot, which is considered less than required for a six foot high wall, assuming no passive resistance. The walls, however, have not moved. An anti-seepage wall extends from the spillway wall into the embankment on each side of the spillway. The spillway slab was placed on a 6-inch thick gravel bed.

Both the 12-inch drawdown pipe and the 18-inch by-pass pipe were encased in concrete and have two anti-seepage collars.

D. Operating Records

Operating records for this dam have not been maintained by the owner.

E. Post Construction Changes

There are no indications that post construction modifications have been made to the dam or its appurtenant structures.

F. Seismic Stability

This dam is located in Seismic Zone 1, and it is considered that the static stability is sufficient to withstand minor earthquake-induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection and the review of the construction drawings indicates that Kehm Run Dam is in poor condition. The construction drawings indicate an adequate embankment section. The lack of a cutoff trench, however, could be the cause of the seepage at the downstream toe. The heavy growth of brush prevented close observation and indicates poor maintenance procedures.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is small and the hazard classification is significant. These classifications indicate that the Spillway Design Flood (SDF) should be in the range of the 100 year flood to one-half the Probable Maximum Flood (PMF). The recommended SDF for this structure is the 100 year flood.

The hydrologic and hydraulic computations indicate that the spillway discharge capacity is sufficient to pass the SDF without overtopping the embankment. The spillway is considered to be adequate.

B. Adequacy of Information

The design information contained in the files, combined with the visual inspection, are considered to be sufficiently adequate for making a reasonable assessment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Additional Studies

A professional engineer, experienced in the design and construction of dams, should be engaged after removal of the brush and trees for an evaluation of the seepage condition at and beyond the downstream toe. His evaluation will determine the need of further studies of this condition.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for implementations by the owner:

1. That all brush and trees be removed from the embankment.

2. That a professional engineer, experienced in the design and construction of dams, evaluate the seepage condition and wet condition at the downstream toe and in the immediate downstream area. His report should indicate if corrective measures are required.
3. That a method be provided for upstream closure of the drawdown pipe.
4. That the crack in the spillway wall be monitored and corrective measures be taken if any movement occurs.
5. That the embankment be reseeded to provide a protective cover.
6. That a maintenance program be established for regular maintenance of the embankment.
7. That a formal surveillance and downstream warning system be developed for use during periods of high or prolonged rainfall.
8. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

APPENDIX A

CHECK LIST OF VISUAL INSPECTION REPORT

APPENDIX A

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 67-483

NDI NO. PA- 01029

NAME OF DAM Kehm Run Dam HAZARD CATEGORY Significant

TYPE OF DAM Zoned earthfill

LOCATION York TOWNSHIP York COUNTY, PENNSYLVANIA

INSPECTION DATE 4/27/81 WEATHER Warm, Sunny TEMPERATURE 60's

INSPECTORS: R. Houseal (Recorder)

OWNER'S REPRESENTATIVE(s):

H. Jongsma

Dr. Ray Kehm - Owner

R. Shireman

A. Bartlett

NORMAL POOL ELEVATION: 610 (U.S.G.S.) AT TIME OF INSPECTION: _____

BREAST ELEVATION: 614.50 (Design) POOL ELEVATION: 610+

SPILLWAY ELEVATION: 610.0 TAILWATER ELEVATION: _____

MAXIMUM RECORDED POOL ELEVATION: Est. about 1 foot over spillway, 1972.

GENERAL COMMENTS:

Stewart and March of York, Pennsylvania, were the contractors. Designed spillway capacity for 50 year storm according to the owner.

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None detectable.
B. UNUSUAL MOVEMENT BEYOND TOE	None observed.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None observed--growth too dense.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal - straight line. Vertical - refer to Profile Survey, Plate A-II.
E. RIPRAP FAILURES	Dumped rock on upstream slope--could not observe closely due to dense growth.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Appears to be sound on left with spillway. Right side abuts with natural hillside. Some seepage at toe on this side of embankment.
G. SEEPAGE	Left slope downstream--near spillway outlet channel--at least 30' to 40' wide. Mid-length and on right side--standing water slight flow from toe of embankment.
H. DRAINS	None detected.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Dense brush and small trees cover downstream slope. Brush and grass--some small trees on upstream slope. Crest is covered with knee high grass.

VISUAL INSPECTION
OUTLET WORKS

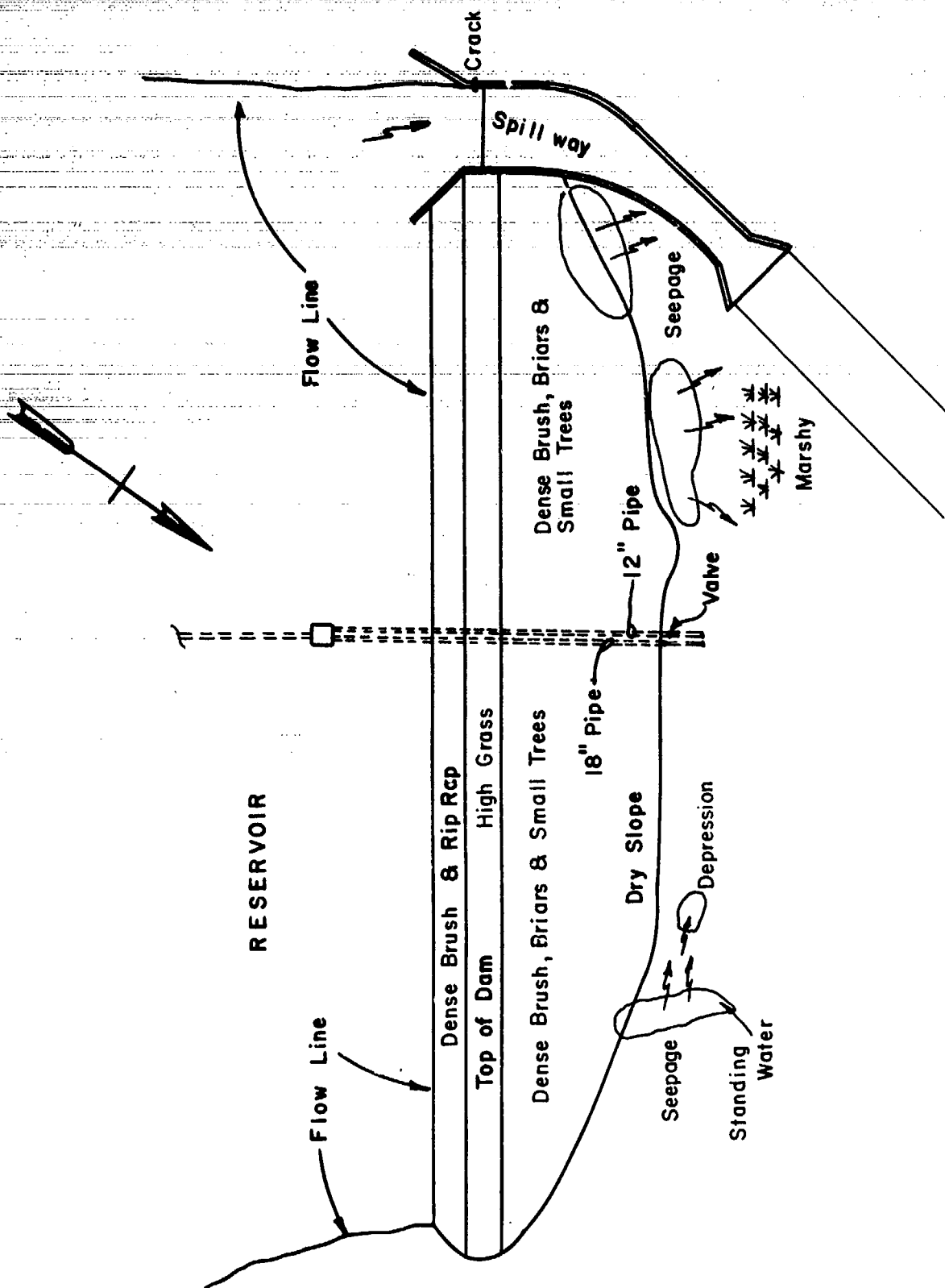
	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	18" concrete by-pass from upstream end of reservoir activated during high flows. 12" steel pipe with downstream control for drawdown.
B. OUTLET STRUCTURE	Two pipes in ditch.
C. OUTLET CHANNEL	Overgrown creek bed.
D. GATES	Gate on 18-inch pipe at upstream end of reservoir. Valve at downstream end of draw-down pipe.
E. EMERGENCY GATE	None.
F. OPERATION & CONTROL	Owner stated that 12-inch valve is opened in fall.
G. BRIDGE (ACCESS)	None.

VISUAL INSPECTION
SPILLWAY

	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Directly from reservoir at left side of embankment.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Uncontrolled ogee weir--good condition. Left spillway wall--vertical crack from top of weir to top of wall. Some surface deterioration of concrete.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Concrete walls and slab. Refer to plans for configuration and dimensions. Stilling basin--small plunge pool of natural stream rocks at end of spillway outlet channel. Walls and slabs in good condition.
D. BRIDGE & PIERS	None.
E. GATES & OPERATION EQUIPMENT	None.
F. CONTROL & HISTORY	None.

VISUAL INSPECTION

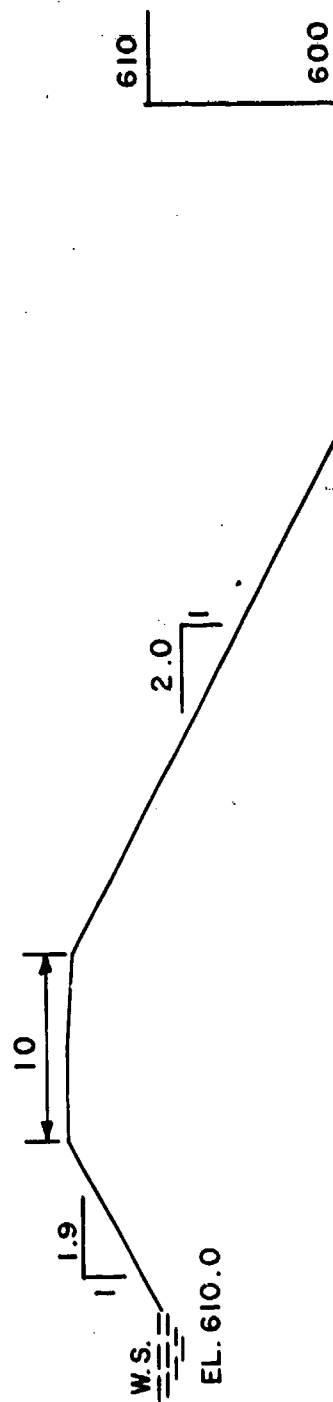
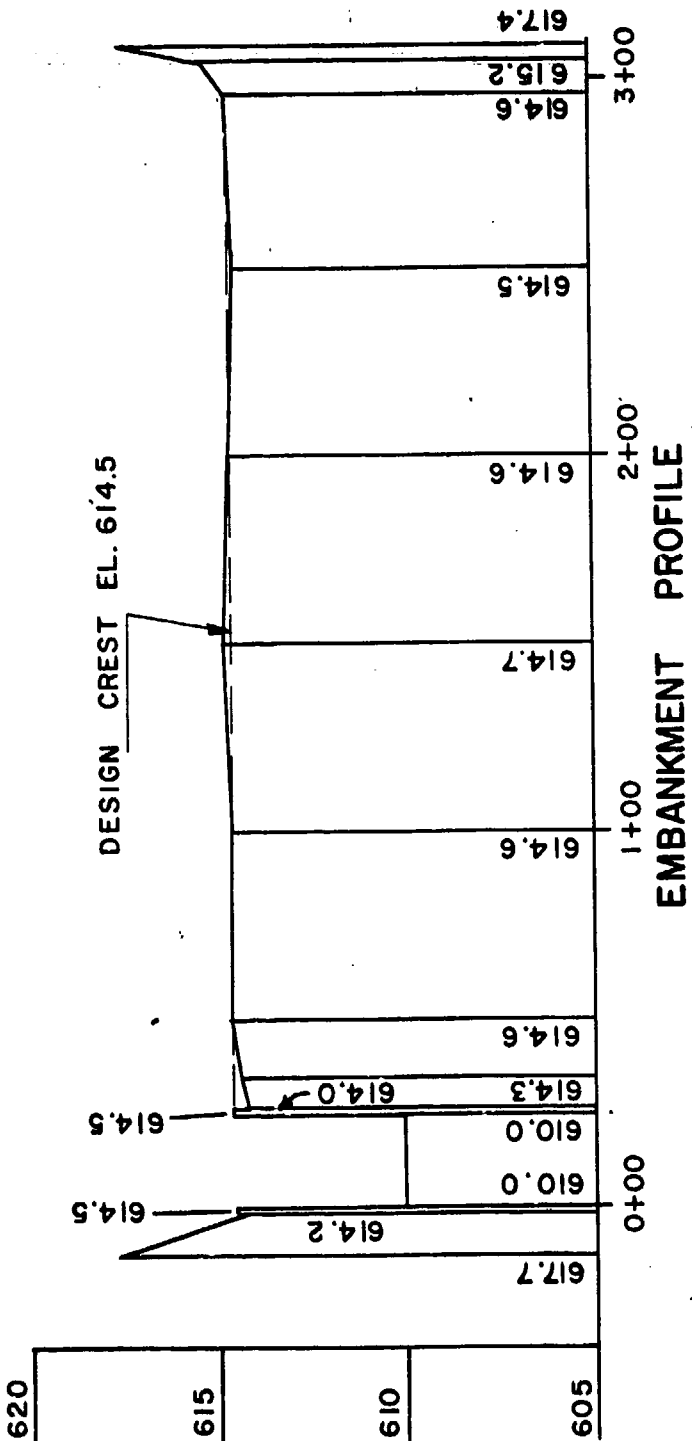
	OBSERVATIONS AND REMARKS
<u>INSTRUMENTATION</u>	
Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
<u>RESERVOIR</u>	
Slopes	Grassed 2:1 to 2.5:1 slope on left side. Remainder of area is trees to the water's edge.
Sedimentation	Owner mentioned that siltation has reduced the capacity of the lake, but he does not know how much.
Watershed Description	Some wooded, some farmland.
<u>DOWNSTREAM CHANNEL</u>	
Condition	Natural stream.
Slopes	Stable.
Approximate Population	Estimated at eight.
No. Homes	Farm house, barn, house and greenhouse.



KEHM RUN DAM
PA-01029
INSPECTION SURVEY
PLATE A-I

SURVEYED

4-27-81



EMBANKMENT SECTION STA. 1+50

EL. 593.8

EL. 589.5 12" Drawdown Pipe

EL. 587.3 18" By-Pass Pipe



KEHM RUN DAM
PA-01029
INSPECTION SURVEY

PLATE A-II

SURVEYED 4-27-81

APPENDIX B

CHECK LIST OF ENGINEERING DATA

APPENDIX B

CHECK LIST
ENGINEERING DATA

PA DER # 67-483

NDI NO. PA- 01029

NAME OF DAM KEHM RUN DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	Not available.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - York, PA See Plate II, Appendix E
CONSTRUCTION HISTORY	Contractor: Stewart and March, York, PA. Completion date: January, 1954.
GENERAL PLAN OF DAM	Refer to Plate IV, Appendix E.
TYPICAL SECTIONS OF DAM	Refer to Plate III, Appendix E.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	Refer to plan and typical section of dam. Not available.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	No records.
DESIGN REPORTS	Not available.
GEOLOGY REPORTS	No report.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No computations.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	Six test holes drilled and plotted on Plates III & IV, Appendix E. None. None.
POST CONSTRUCTION SURVEYS OF DAM	None reported.
BORROW SOURCES	Reservoir area.

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	No records. Estimated by owner at elevation 611 during Agnes in June 1972.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	No records.
SPILLWAY PLAN, SECTIONS AND DETAILS	Plate IV, Appendix E.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	One 12-inch valve on drawdown pipe (Plate III, Appendix E).
CONSTRUCTION RECORDS	No records.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	One inspection by PennDER in June 1960. Good condition. No leakage.
MISCELLANEOUS	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: farm land

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 610 Acre-Feet 36.8TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 614 Acre-Feet 59.5MAXIMUM DESIGN POOL: Elev. 614TOP DAM: Elev. 614

SPILLWAY:

- a. Elevation 614
- b. Type concrete ogee section
- c. Width 24'
- d. Length --
- e. Location Spillover left abutment
- f. Number and Type of Gates none

OUTLET WORKS:

- a. Type 12" diameter pipe with downstream valve
- b. Location center of dam
- c. Entrance inverts 593
- d. Exit inverts 589.5
- e. Emergency drawdown facilities 12" pipe with valve

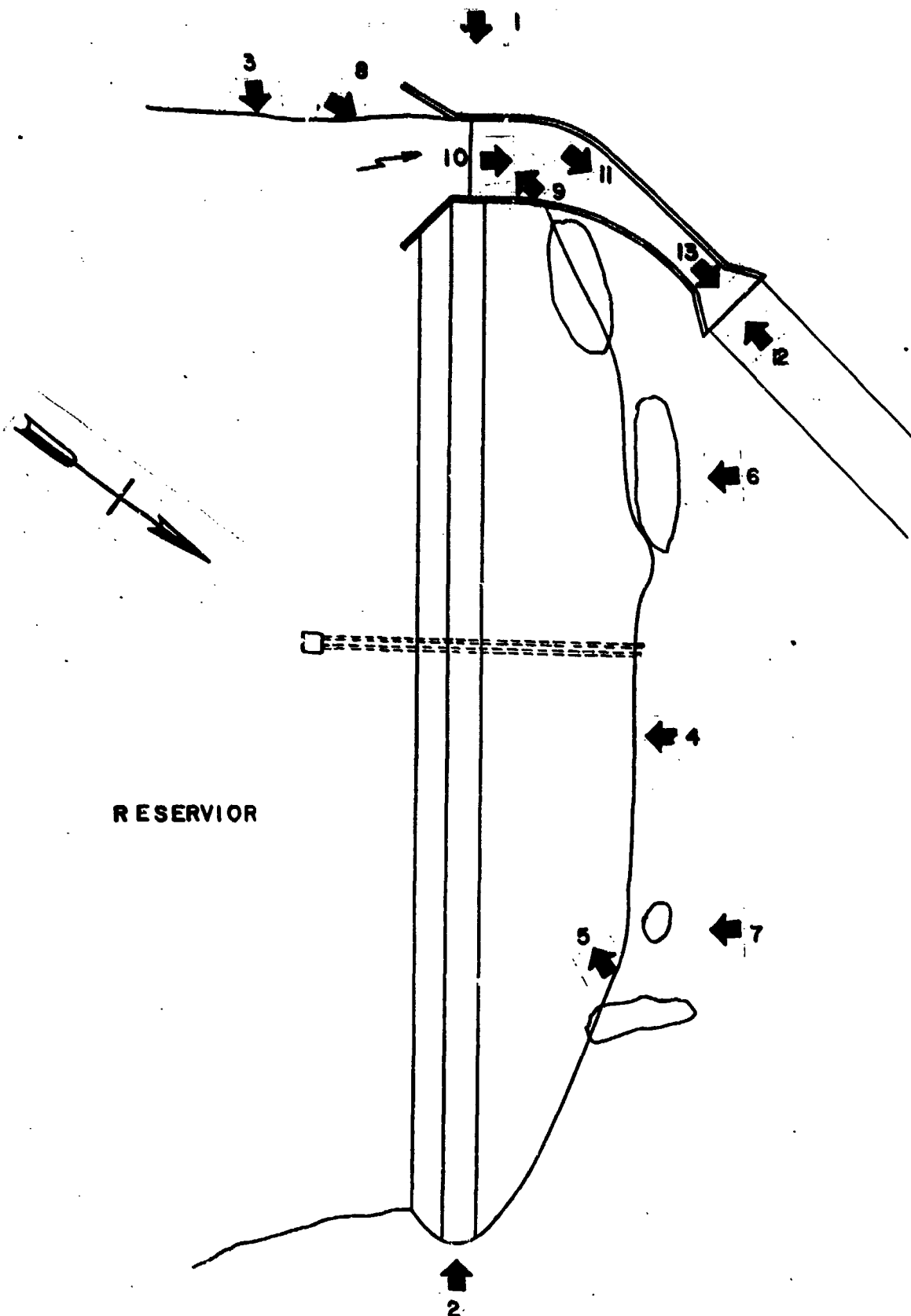
HYDROMETEOROLOGICAL GAGES:

- a. Type none
- b. Location
- c. Records

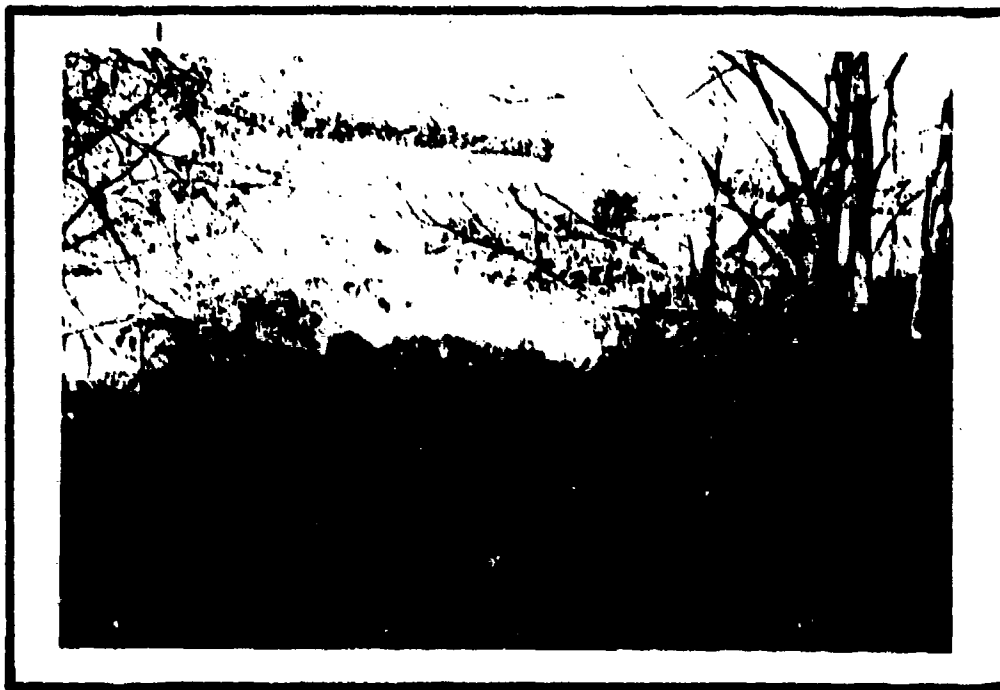
MAXIMUM NON-DAMAGING DISCHARGE: 752 cfs

APPENDIX C
PHOTOGRAPHS

APPENDIX C



KEHM RUN DAM
PA-01029
KEY MAP OF PHOTOGRAPHS
PLATE C-I



OVERVIEW FROM RIGHT ABUTMENT - NO. 2



UPSTREAM SLOPE - NO. 3
NOTE: BRIARS AND TREES



VIEW OF DOWNSTREAM SLOPE - NO. 4
NOTE: BRIARS AND TREE



VIEW OF DOWNSTREAM SLOPE - NO. 5

PA-01029
Plate C-III



VIEW OF SEEPAGE AREA - NO. 6
NOTE: FOOTPRINT IN WET AREA



VIEW OF DEPRESSION - NO. 7



FOREBAY AREA OF SPILLWAY -- NO. 8



CRACK IN LEFT SPILLWAY WALL -- NO. 9

PA-01029
Plate C-V



SPILLWAY DISCHARGE CHANNEL - NO. 10
NOTE: GROWTH BEHIND WALLS



SPILLWAY DISCHARGE CHANNEL - NO. 11



SPILLWAY DISCHARGE CHANNEL LOOKING UPSTREAM - NO. 12



DOWNSTREAM CHANNEL OF SPILLWAY - NO. 13

APPENDIX D
HYDROLOGY AND HYDRAULIC CALCULATIONS

APPENDIX D

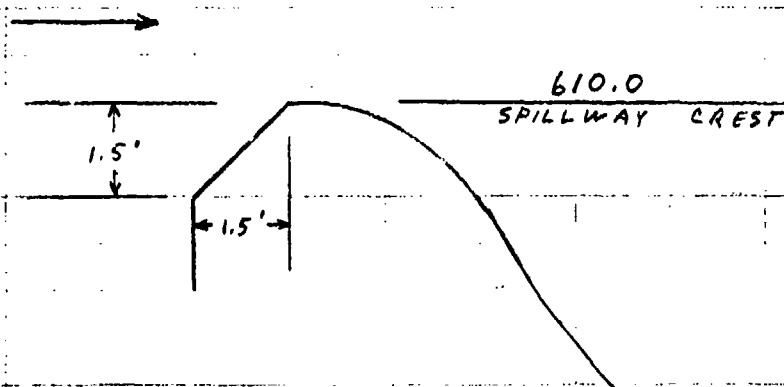
BY RLS DATE 5/9/81
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 1 OF 7
PROJECT D0590

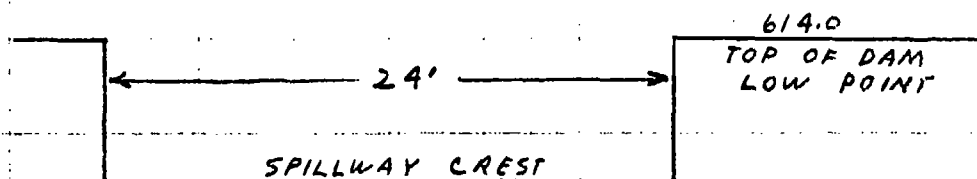
KEHM DAM

SPILLWAY RATING



OGEE SECTION
WITH SLOPING FACE

$$C = 3.88 \times 1.01 = 3.92 \quad (\text{SMALL DAMS FIG. 249+251})$$



$$Q = CLH^{3/2}$$

$$H = 614 - 610 = 4'$$

$$Q = 3.92 \times 24 \times (4)^{1.5}$$

$$= 752 \text{ CFS}$$

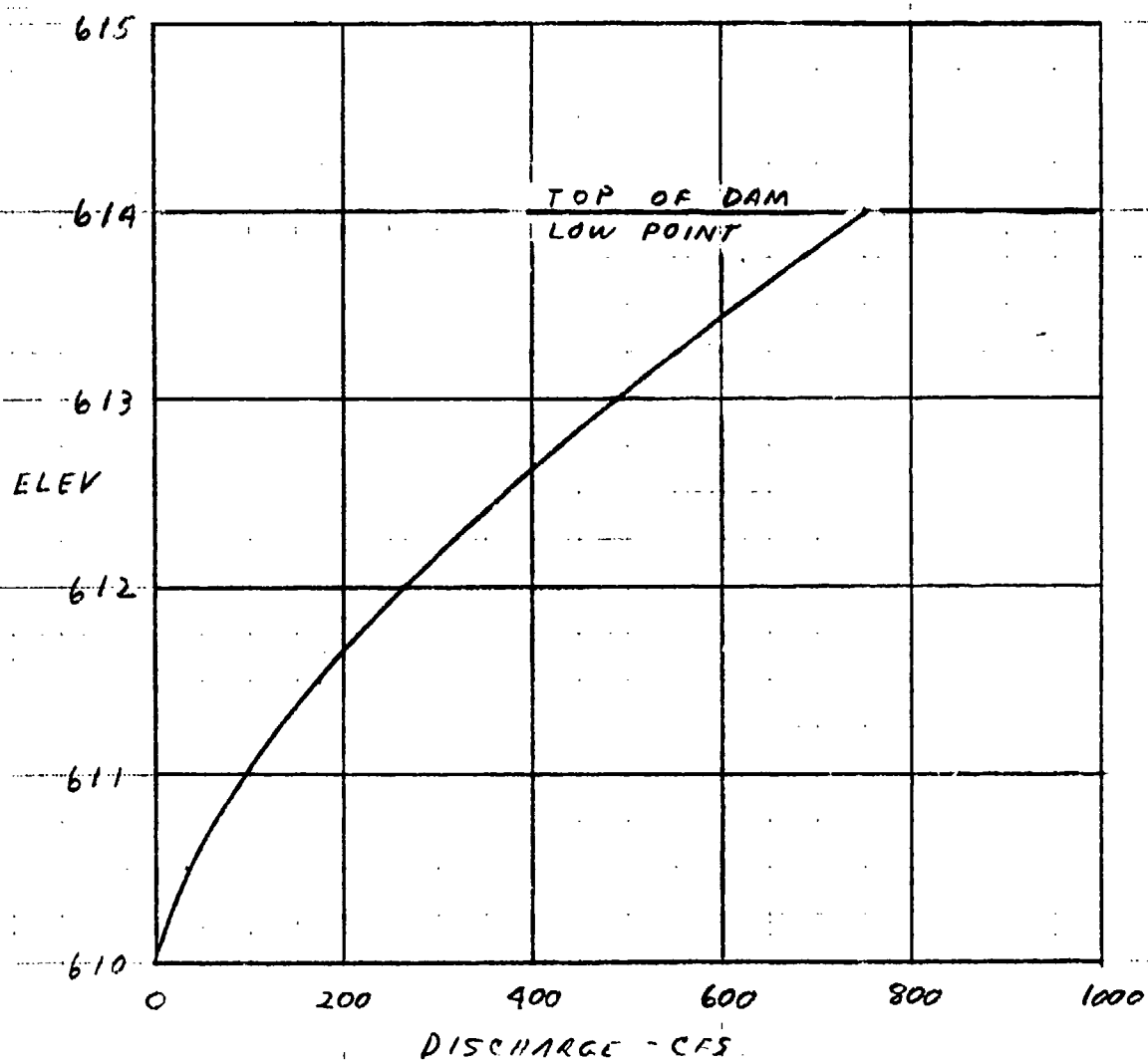
BY RLS DATE 6/18/81
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 2 OF 7
PROJECT D.0590

KEHM DAM

SPILLWAY RATING CURVE



BY RLS DATE 6/18/81
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 3 OF 7
PROJECT D0590

KEHM DAM

DISCHARGE THROUGH OUTLET WORKS

12" DIA. PIPE THROUGH EMBANKMENT

INLET ELEV. = 593.0

C = 0.6 (KINGS HDBK)

AT POOL ELEV 610

$$H = 610 - 593.5 = 16.5'$$

$$Q = CA \sqrt{2gH}$$

$$= 0.6 \times \pi \times \frac{12}{4} \times (2 \times 32.2 \times 16.5)^{0.5}$$

$$= 15 \text{ CFS}$$

AT LOW POOL ELEV 598

$$H = 598 - 593.5 = 4.5'$$

$$Q = CA \sqrt{2gH}$$

$$= 0.6 \times \pi \times \frac{12}{4} \times (2 \times 32.2 \times 4.5)^{0.5}$$

$$= 8 \text{ CFS}$$

BY RLS DATE 6/18/51
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 4 OF 7
PROJECT D0590

KEHM DAM

DISCHARGE THROUGH BYPASS LINE

18" DIA. PIPE FROM UPSTREAM DIVERSION DAM

PIPE LENGTH = APPROX. 925'

APPROX INVERT OF UPSTREAM END = 610

INVERT OF DOWNSIDE END = 587.3

ASSUME TAILWATER ELEV = 588.8

APPROX DIVERSION DAM POOL ELEV. = 616

$$H = 616 - 588.8 = 27.2'$$

$$S = H/L = 27.2/925 = .0294$$

$$Q = 1.486 \times A \times R^{2/3} \times S^{1/2} / N$$

$N = .015$ (KINGS HDBK)

$$Q = 1.486 \times \pi \times \left(\frac{1.5}{4}\right)^2 \times \left(\frac{1.5}{4}\right)^{2/3} \times (.0294)^{1/2} / .015$$

$$= 16 \text{ CFS}$$

STORAGE

36.8 AC-FT AT NORMAL POOL (ELEV 610) (FROM DER FILES)

PLANIMETERED AREAS : ELEV. 610 = 4.6 A.

(QUAD SHEET)

ELEV. 620 = 10.1 A.

INTERPOLATED AREA : ELEV 614 = 6.8 A.

$$\text{STORAGE} = 36.8 + \left(\frac{H}{3} (A_1 + A_2 + (A_1 A_2)^{0.5})\right)$$

$$= 36.8 + \left(\frac{4}{3} (4.6 + 6.8 + (4.6 \times 6.8)^{0.5})\right) = 59.5 \text{ A-F}$$

BY RLS DATE 6/18/81
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 5 OF 7
PROJECT D0590

KEHM DAM

MAXIMUM KNOWN FLOOD AT DAM SITE

THERE ARE NO RECORDS OF FLOOD LEVELS AT THIS DAM. BASED ON THE RECORDS OF THE STREAM GAGING STATION AT NEARBY WINTERSTOWN, PA. (D.A. = 5.17 SQ. MI.) THE MAXIMUM DISCHARGE AT THE GAGE OCCURRED IN 1975 WHEN A DISCHARGE OF 3930 CFS WAS RECORDED. THE MAXIMUM INFLOW TO KEHM DAM IS ESTIMATED TO BE:

$$\left(\frac{.85}{5.17} \right)^{0.8} \times 3930 = 953 \text{ CFS}$$

DESIGN FLOOD

SIZE CLASSIFICATION

MAXIMUM STORAGE = 59.5 ACRE- FEET

MINIMUM HEIGHT = 27 FEET

SIZE CLASSIFICATION IS "SMALL"

HAZARD CLASSIFICATION

GREENHOUSE AND FARM ARE LOCATED NEAR THE DOWNSTREAM CHANNEL.

USE "SIGNIFICANT"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO THE 100 YEAR FLOOD TO ONE HALF THE PROBABLE MAXIMUM FLOOD.

BY RLS DATE 6/18/71
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 6 OF 7
PROJECT D0590

KEHM DAM

100 YR FLOOD

REF: "HYDROLOGIC STUDY, TROPICAL STORM AGNES"
NORTH ATLANTIC DIVISION, U.S. ARMY, CORPS OF ENGINEERS.

DRAINAGE AREA = 0.88 SQ. MI.

(FIG. 21) $C_m = 2.01$

$$\text{LOG}(Q_m) = C_m + .75 \text{ LOG}(DA)$$

$$= 2.01 + .75 \text{ LOG}(.88) = 1.968$$

(FIG. 22) $C_s = .35$

$$S = C_s - 0.05 \text{ LOG}(DA)$$

$$= .35 - 0.05 \text{ LOG}(.88) = .353$$

(FIG. 23) $\text{SKEW} = .47$

$$\text{STANDARD DEVIATE} = K(P, S) = 2.6646$$

$$\text{LOG}(Q(P)) = \text{LOG}(Q_m) + K(P, S)$$

$$\text{LOG}(Q_1) = 1.968 + (2.6646 \times .353)$$

$$= 2.909$$

$$Q_1 = 810 \text{ CFS}$$

BY RLS DATE 6/18/81
CHKD. BY _____ DATE _____
SUBJECT _____

BERGER ASSOCIATES

SHEET NO. 7 OF 7
PROJECT D0590

KEHM DAM

100 YR FLOOD

REF: WATER RESOURCES BULLETIN NO. 13, "FLOODS IN
PENNSYLVANIA", PENNA. DEPT. OF ENVIRONMENTAL RESOURCES.

DRAINAGE AREA = .88 SQ. MI.

(PLATE 1) REGION 6

MODEL 6-B

$$Q_T = C A^x$$

$$Q_{100} = 259 \times (.88)^{1.05}$$

$$Q_{100} = 226 \text{ CFS}$$

100 YR FLOOD (ADJUSTED)

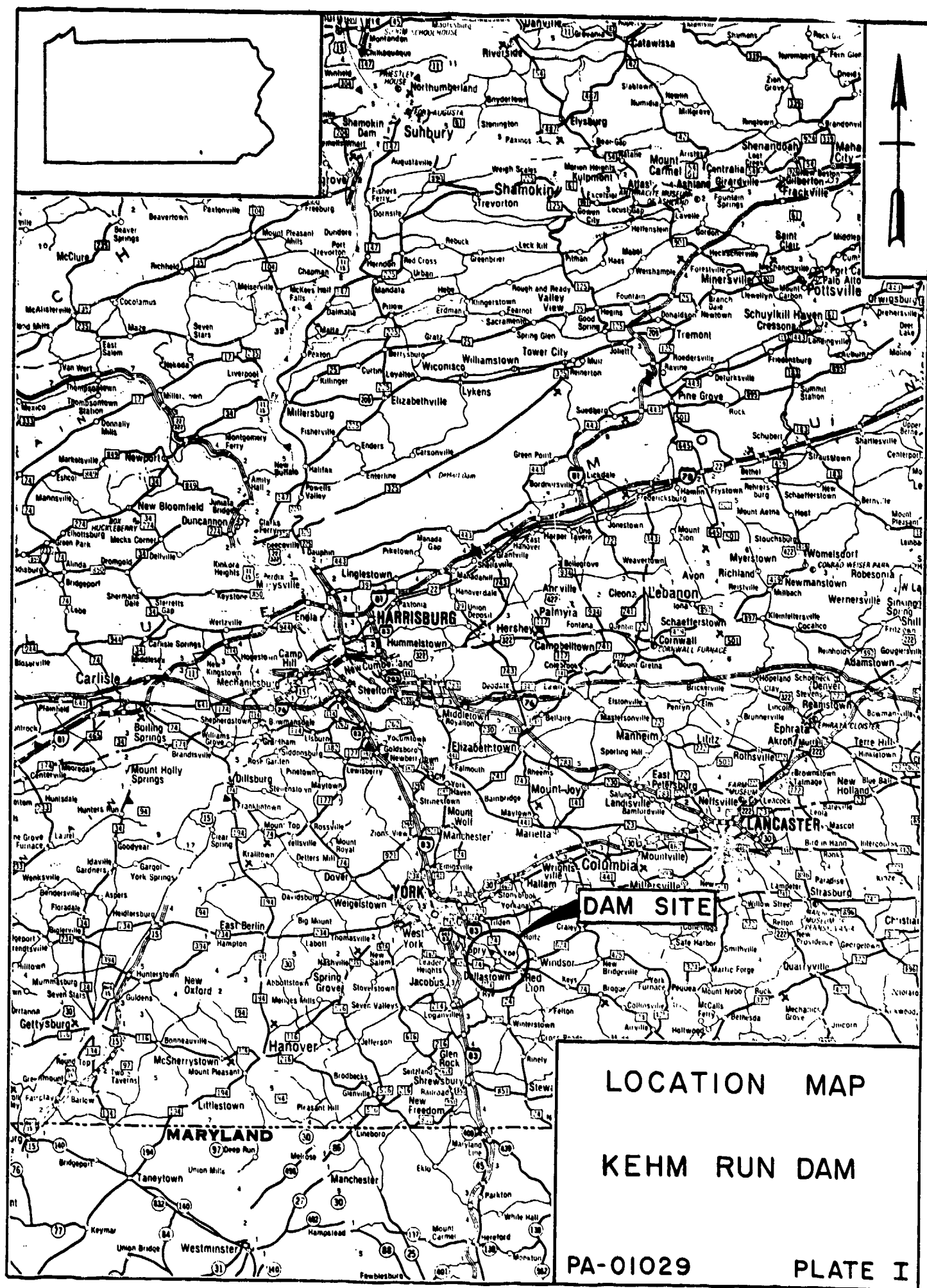
$$(226 + 810) / 2 = Q$$

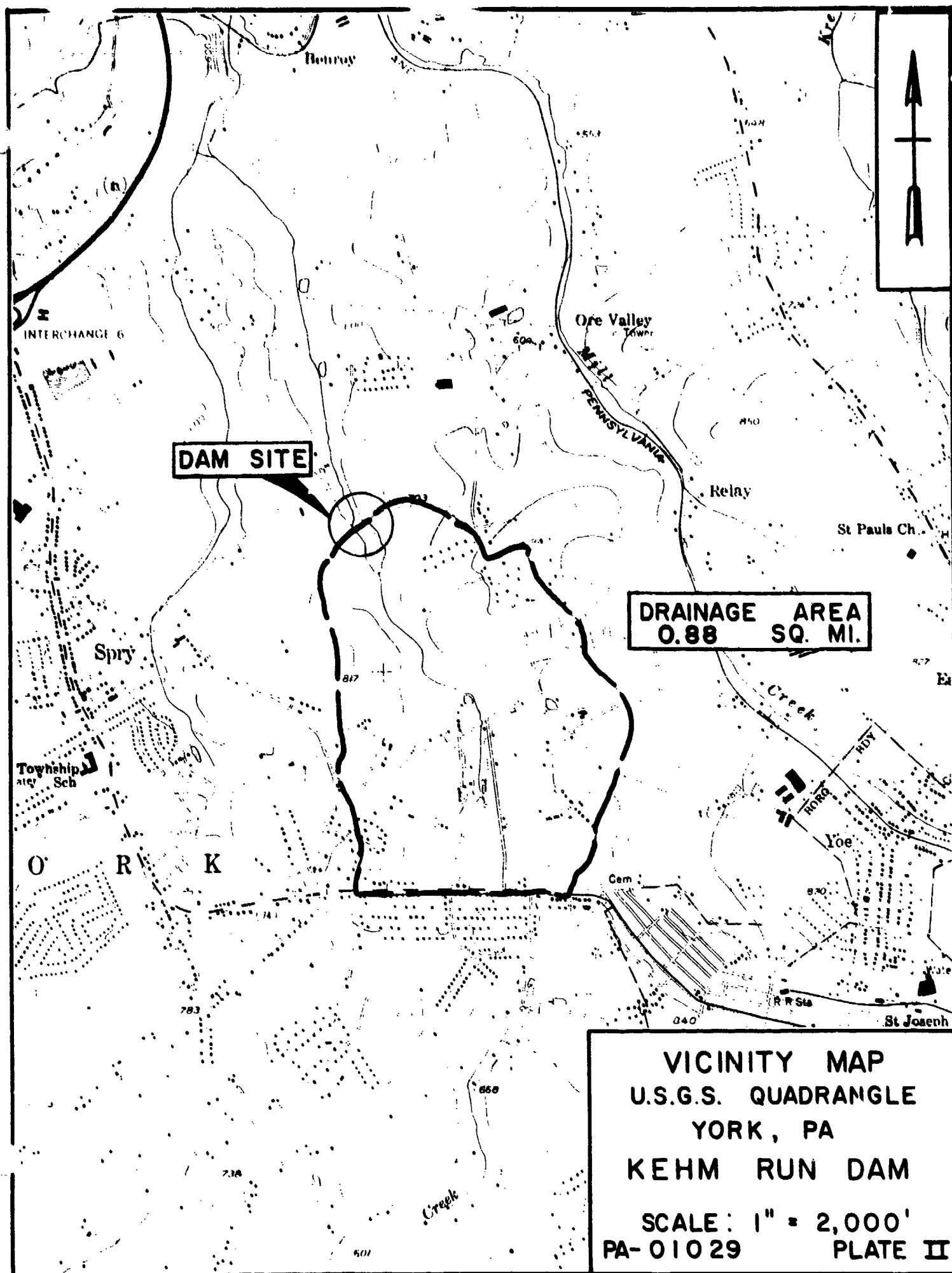
$$Q = 518 \text{ CFS}$$

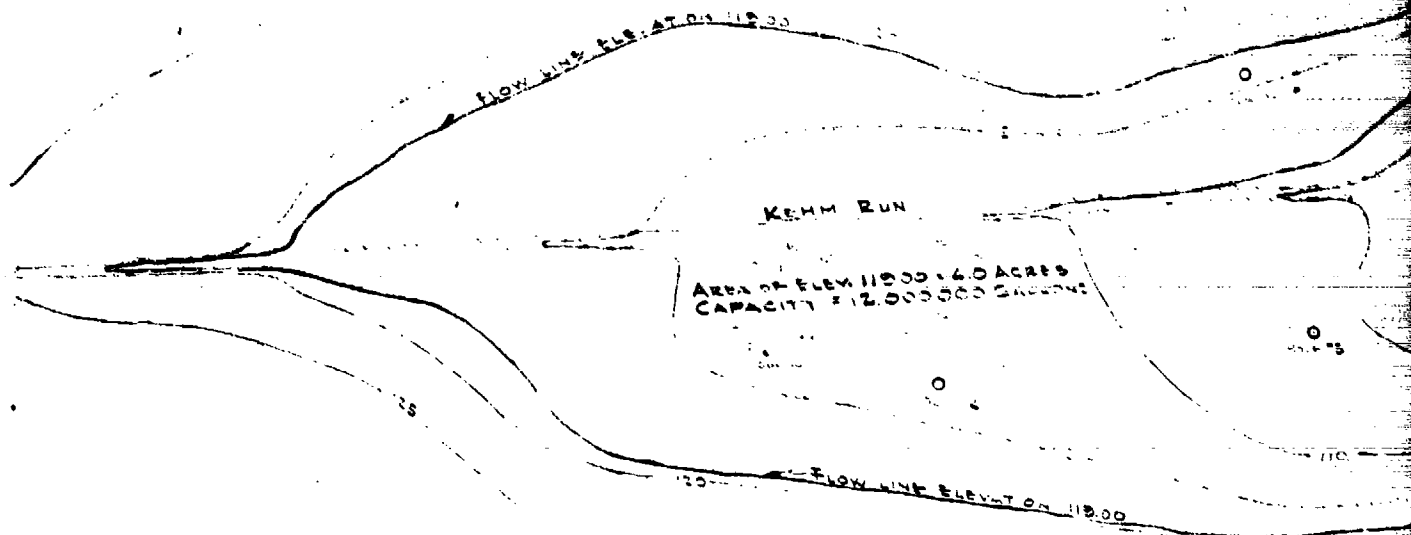
APPENDIX E

PLATES

APPENDIX E

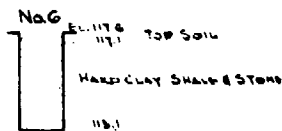
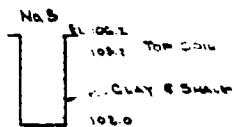
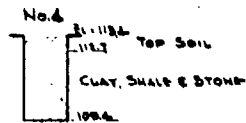






NOTE: CAPACITY OF LAKE AREA AT ELEVATION 11000
COMPUTED FROM ORIGINAL CONTROLLED FLOODING
GALLONS. ADDITIONAL CAPACITY OF 3,000,000 GALLONS
WILL BE CREATED AFTER EMERGENCY FLOOD FOR
DAM IS OBTAINED FROM LAKE AREA.

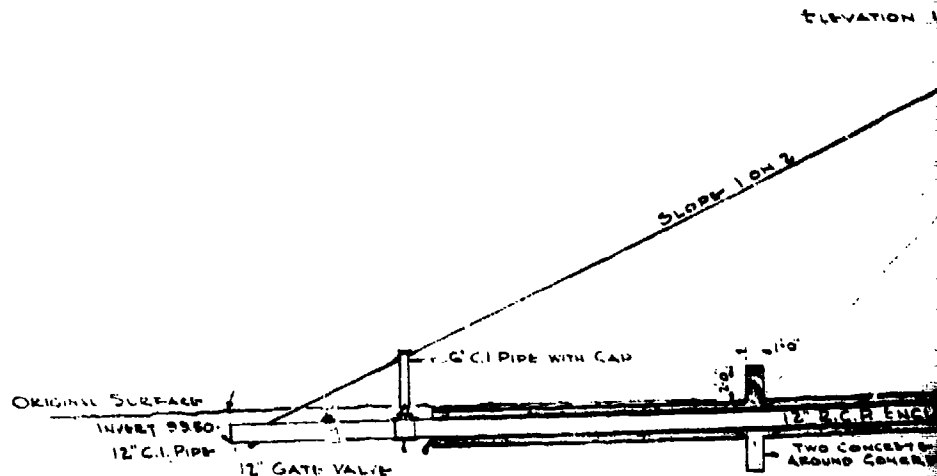
DR. KEIM LAKE



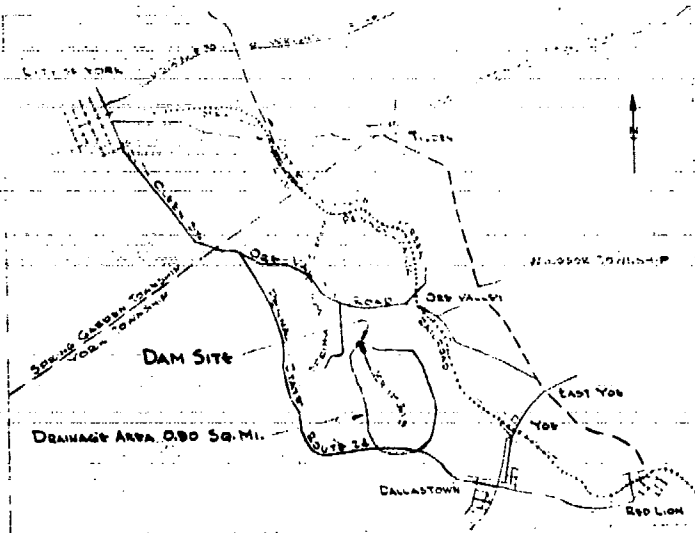
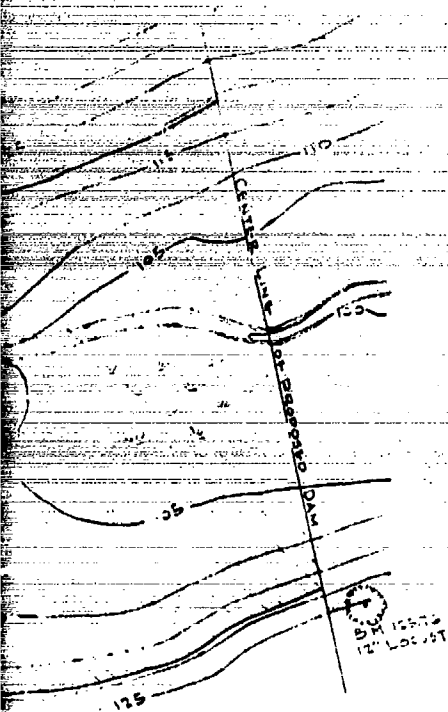
LOG OF TEST HOLES IN LAKE AREA

VERTICAL SCALE $\frac{1}{4}$ " = 1'0"

NOTE: TOP OF 12" GATE VALVE TO HAVE
3'-6" MIN. COVER.
PROVIDE STEM WRENCH TO OPERATE
GATE VALVE.



BELL END CONNECTION OF 12" C.I. PIPE WITH 12" R.C. PIPE BOTH OUTLET
AND SEDIMENTATION CONTROL LINE TO BE IN 6" CONCRETE ENCLOSURE
FOR AT LEAST 300 FEET.



LOCATION PLAN
Scale 1" = 1 Mile

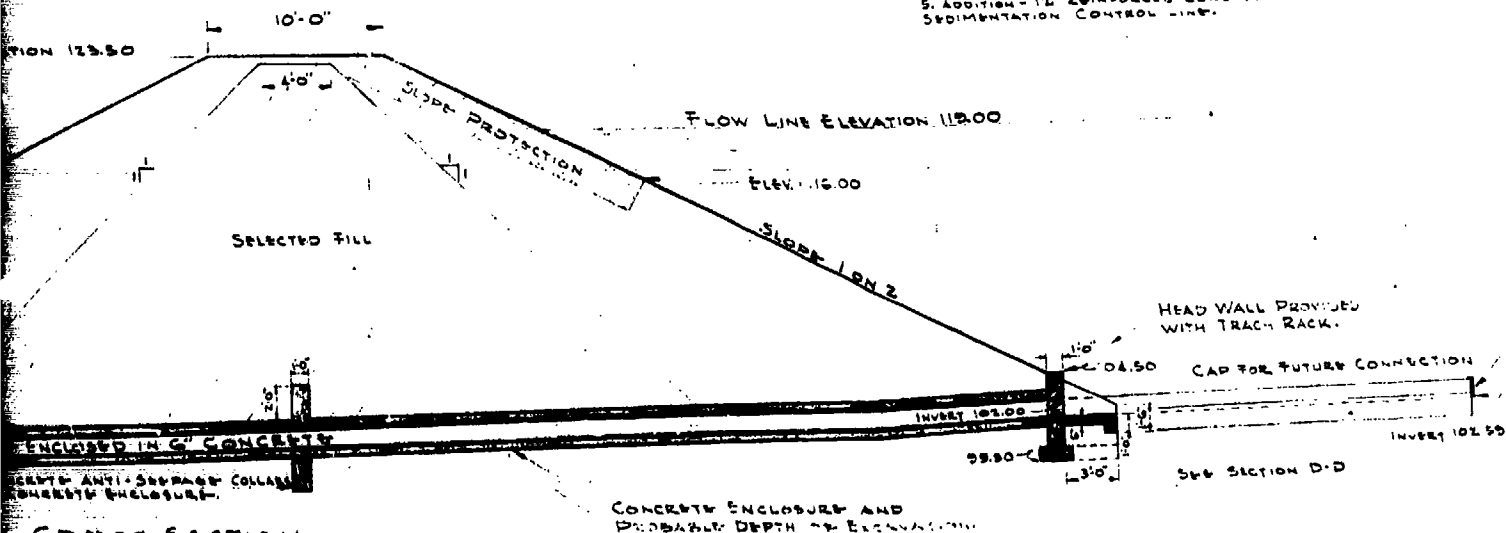


PROPOSED
DR. RAY KEHM DAM
ON
KEHM RUN

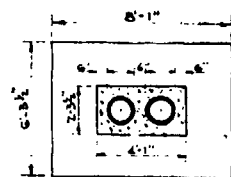
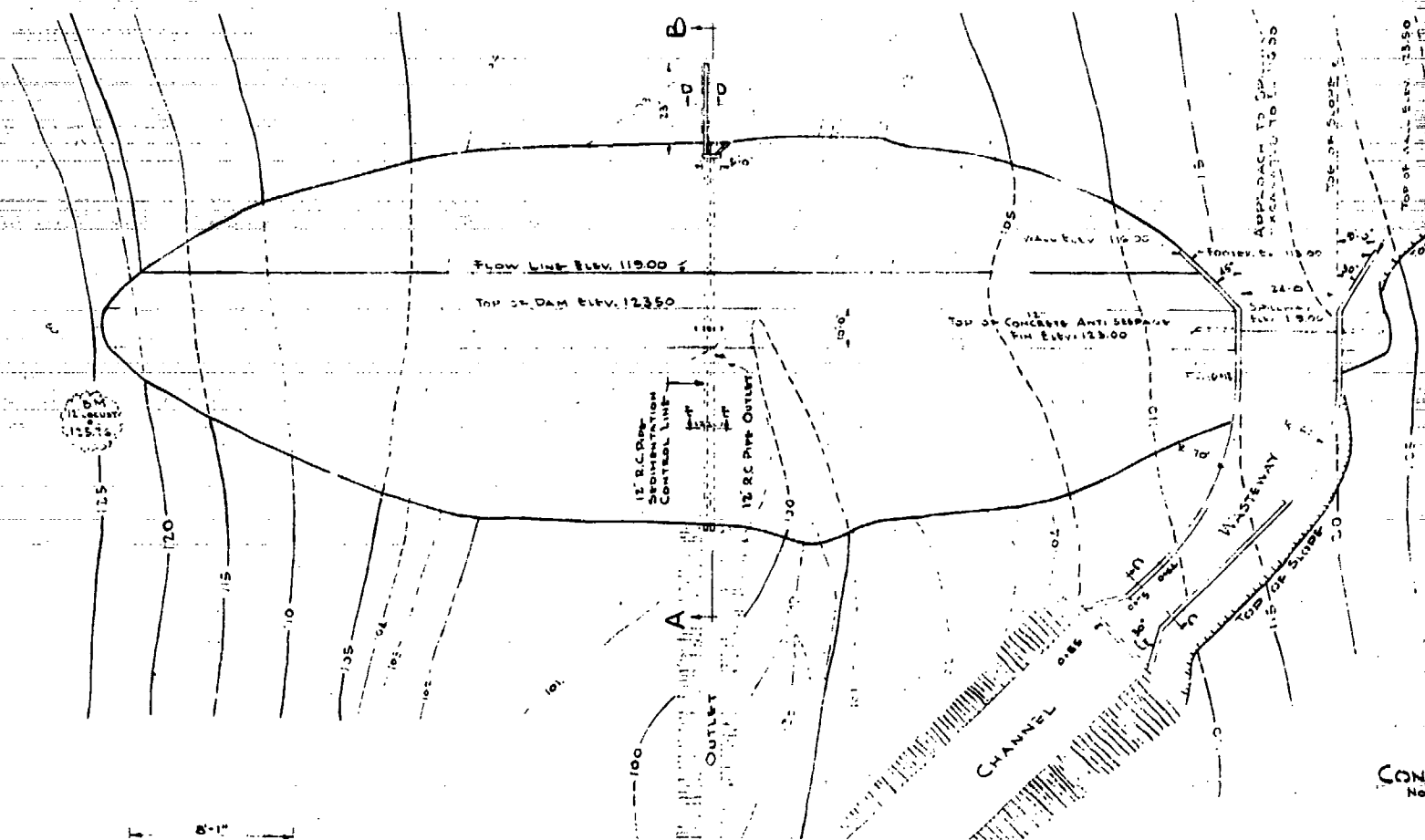
AS SHOWN JANUARY 1953
SHEET 1 OF 2
BY R. W. MILLER

NOTE: SLOPE PROTECTION
2' SELECTED STONE RIP-RAP
ELEVATION 116.00 TO 123.50 ALONG
ENTIRE LENGTH

- REVISED FEB. 12, 1953
1. ADDITION - TWO CONCRETE ANTI SEEPAGE COLLARS.
REVISED MAY 28, 1953
1. TOP OF EMBANKMENT CHANGED TO ELEVATION 123.50
2. DOWNSTREAM SLOPE CHANGED TO ONE VERTICAL ON TWO HORIZONTAL.
3. OUTLET PIPE CHANGED TO 12" REINFORCED CONCRETE PIPE.
4. SLUIE GATE CHANGED TO 12" GATE VALVE.
5. ADDITION - 12" REINFORCED CONCRETE PIPE FOR
SEDIMENTATION CONTROL LINE.



CROSS SECTION
A-B
SCALE 1" = 3'



SECTION E-E
SCALE 1/4" = 1'-0"

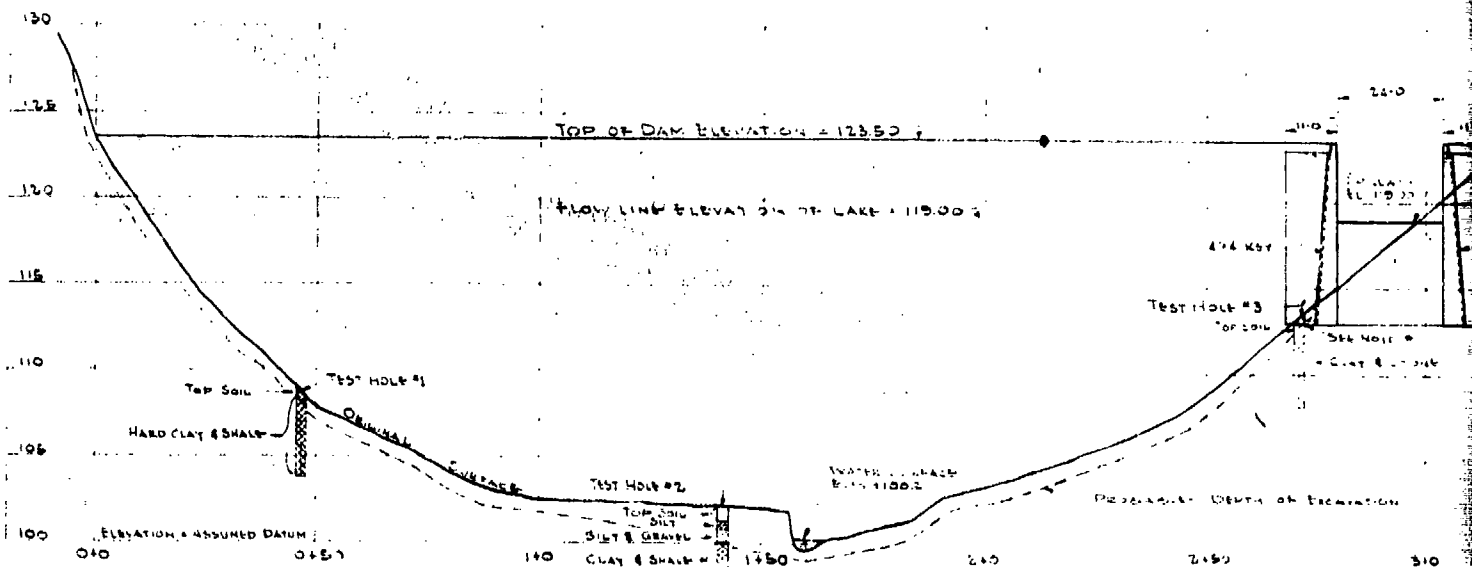
GENERAL PLAN
SCALE 1/4" = 20'



SECTION D-D
SCALE 1/4" = 1'-0"

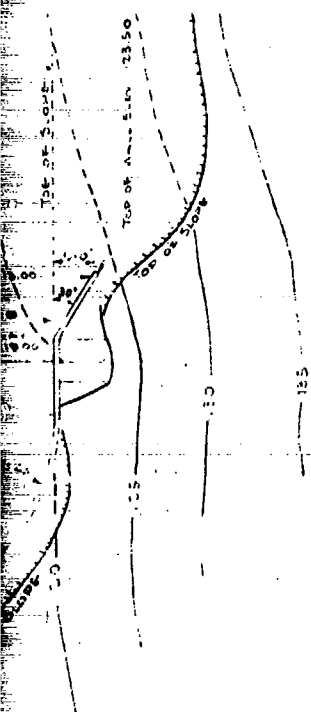
NOTE:-

ON CONCRETE
P-1
EXAMINATION
AND O.I.T.
+ALD
TO BE 6'

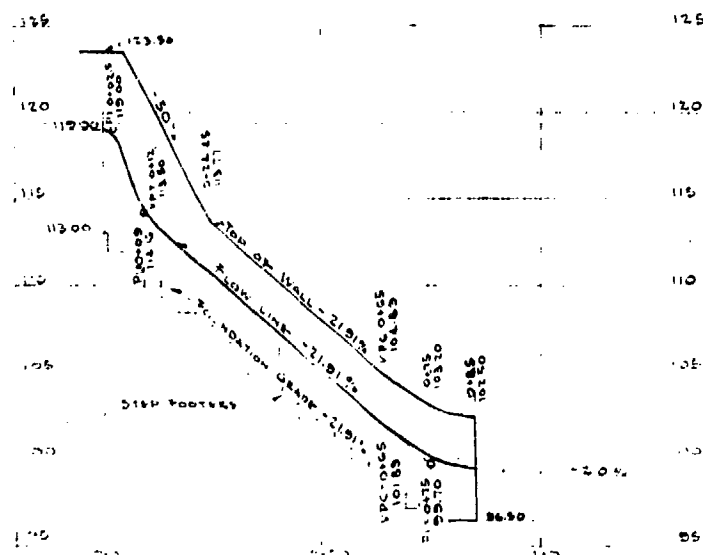
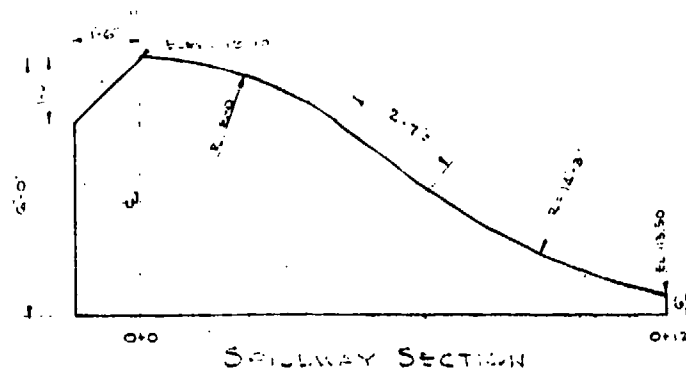


LONGITUDINAL SECTION
SCALE 1/4" = 100'

SECTION
G. TOP OF TYPICAL WALL
H. WASTEWAY SECTION C-C
AND HEIGHT OF WALL AB
I. WASTEWAY PROFILES C-C
J. SPILLWAY SECTION C-C
K. ADDITIONAL 12' R.D.P. BARS

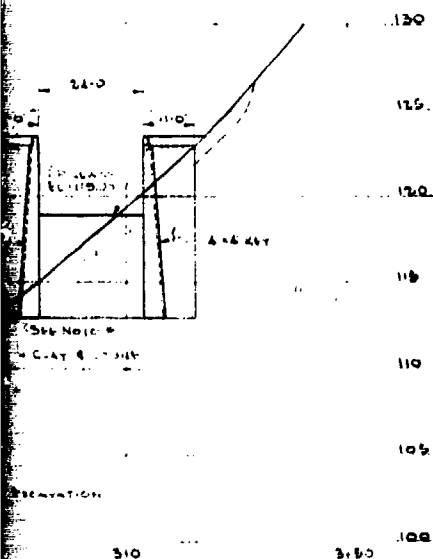


CONSTRUCTION JOINT
NOT OVER 20'-0" OC.

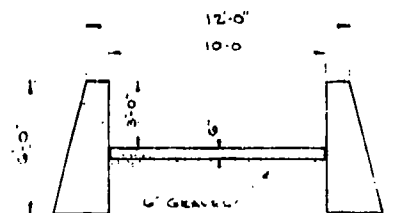


WASTEWAY PROFILES

NOTE:-
ALL CONCRETE SHALL BE
OF COMPRESSION STRENGTH
CLASS 3000 P.S.I.
FOLLOWING JOINTS AT 0+12.0+13
AND 0+15 WASTEWAY SECTION.
ALL CONCRETE FOUNDATIONS
TO BE BUILT ON UNDISTURBED SOIL.



TYPICAL WALL SECTION



WASTEWAY SECTION C-C



DESIGNED BY
DR. RAY KHEIM DAM
ON
KHEIM RUN
JANUARY 1953
SHEET 1 OF 1

PLATE IV
PA-01029

REVISED MAY 26, 1953
TYPICAL WALL SECTION CHANGED TO 1'-0" AT SECTION C-C CONCRETE FLOOR PAVING CHANGED TO 6" AT SECTION C-C WALL ABOVE PAVING 3'-0" PLASTER CHANGED TO 1'-0" PLASTER CHANGED TO MEET NEW WASTEWAY PAVING SECTION. 12" R.C.P. BOTTOM FOUNDATION ON CONTROL LINE WITH TYPICAL SECTIONS.

REVISED MAY 2, 1953
2 ADD 3" CONCRETE ANTI-SLURRY TO BOTTOM OF WALL
3 ADD 3" SLURRY TO GRAVEL UNDER 12" R.C.P. WASTEWAY SECTION.

APPENDIX F
GEOLOGIC REPORT

APPENDIX F

GEOLOGIC REPORT

BEDROCK - DAM AND RESERVOIR

The dam and reservoir are underlain by the lower Cambrian age Harpers phyllite, which is the dominant rock type in the area. This is a dark greenish gray, hard, fine grained, argillaceous, quartzose phyllite with interlayered quartz zones. There are also two other major formations and one minor formation located in the immediate area.

The Antietam Formation lies approximately 1500 feet (0.48 km) to the north of the dam and is delineated by a northeast trending thrust fault. This formation is a light gray, fine grained, hard, vitreous quartzite that eventually grades into the Harpers phyllite. About 500 feet (0.15 km) to the south of the reservoir lies the upper members of the Chickies Formation, which consists of the Chickies slate and Chickies quartz. The third, minor rock type is a hard, fine to medium crystalline diabase, which is a combination of plagioclase feldspar and augite, known locally as ironstone. This younger, Triassic age, rock appear in the form of intrusive dikes. One prominent dike is located some 1500 feet (0.48 km) to the west of the dam and strikes approximately N20°E. Some 3500 feet (1.1 km) to the southeast of the reservoir is another dike with about the same strike as the western dike (see accompanying map).

STRUCTURE

According to the available information, there is a northeast trending thrust fault some 1500 feet (0.48 km) to the north of the dam and an apparent fault some 2000 feet (0.61 km) to the northeast of the reservoir.

Although these two structural features do not directly intersect the dam and its reservoir, the possibility of localized fracturing and fault traces in the immediate vicinity of the dam site still exists. This factor must be taken into account when considering the possibility of subsurface seepage.

OVERBURDEN

The predominant overburden in this area consists of the Manor Channery loam. This is a shallow, instable soil with rapid permeability. It originates from the weathering of the phyllite bedrock. There are also some alluvial soils found in the area, but they make up only a small amount of the soil found in the site area.

AQUIFER CHARACTERISTICS

The joints and cleavage planes in the Harpers Formation are moderately developed, irregularly distributed, and closely spaced, resulting in a low secondary porosity. Normally, this would indicate that subsurface water movement should be minimal. However, with the existence of the thrust fault to the north and an apparent fault to the northeast, subsurface seepage is still a distinct possibility and should not be overlooked.

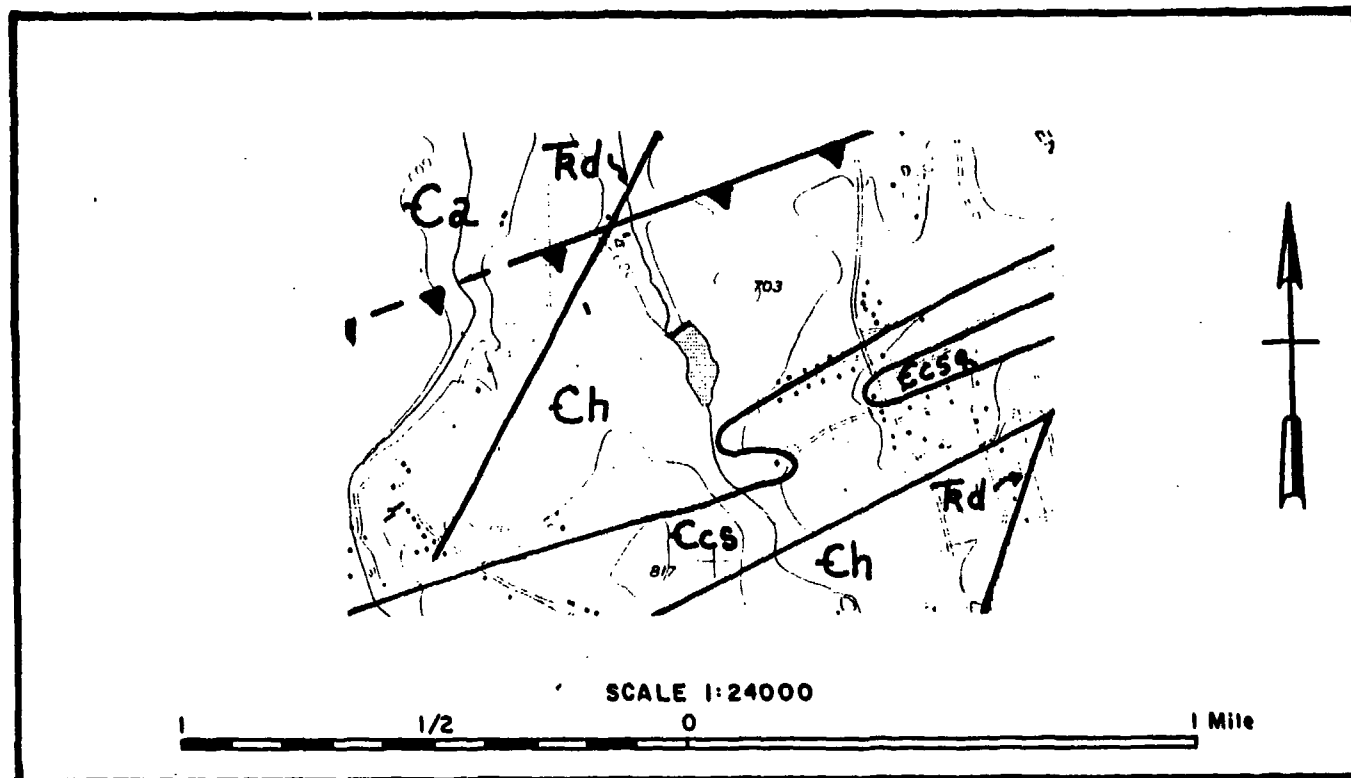
DISCUSSION

The Harpers Formation provides a good quality foundation for heavy structures; however, it should be excavated to sound material prior to construction. According to available construction plans, the dam core was taken to impervious material. This should decrease the possibility of subsurface seepage, but may not eliminate it.

SOURCES OF INFORMATION

1. McGlade, W.G., et al., 1972. Engineering Characteristics of the Rocks of Pennsylvania, Pennsylvania Geological Survey EG-1.
2. Stose, W.G., et al., 1973. Geology and Mineral Resources of York County, Pennsylvania Geological Survey Bulletin C-67.
3. Wilshusen, J.P., 1979. Environmental Geology of the Greater York Area, York County, Pennsylvania. Pennsylvania Geological Survey EG-6.
4. Soil Survey - York County, 1963. Soil Conservation Service U.S.D.A.
5. Pennsylvania Geologic Map Worksheet - York Quadrangle, 1980. Pennsylvania Geological Survey.

GEOLOGICAL MAP - KEHM RUN DAM



LEGEND

Ch

Harpers Phyllite

Ca

Antietam Formation

Ccs

Chickies Slate

Ccsq

Chickies Quartz

Trd

Triassic Diabase Dike